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WET SEASON SPELLING - ECONOMIC INSIGHTS FROM HERD MODELLING.

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INTRODUCTION

Pasture degradation and declining land condition (esp. from overgrazing), is a significant and long-recognised problem across the northern rangelands. Wet season spelling, when systematically applied and supported with conservative pasture utilisation, has demonstrated considerable promise for restoring degraded pastures and their potential for higher levels of cattle production. For example, a study conducted at Virginia Park Station (Charters Towers) demonstrated that degraded pastures (e.g. ABCD rating land condition rating C or poor - Chilcott *et al*. 2003) can be restored back towards better land condition (e.g. land condition B) with strategic application of wet season spelling and appropriate pasture utilisation, particularly when paddocks are initially rested for two wet seasons (Post *et al*. 2006).

While grazing studies have demonstrated the potential for improved animal productivity, the economic value of wet season spelling has received limited attention. We apply insights from the Virginia Park study to a herd economic model to explore the scope for wet season spelling to provide economic benefits for northern enterprises. Projected economic outcomes, comparing gross margin differences over 20 years with/without the spelling program, and some implications for wet season spelling management are discussed.

METHOD

The analysis is based on a hypothetical beef enterprise located in the Charters Towers Goldfields region; with 50% of breeder paddocks in C/C+ land condition adopting a restoration strategy for the whole property, utilising a 3 paddock and 1 spare paddock rotation system. A herd economic model (MacLeod and McIvor 2007) was populated using data and expert opinion of DPI&F Beef research and extension staff and CSIRO Sustainable Ecosystems (Table 1). The property is 28,000 hectares and turns off 18 -24 month old steers. The carrying capacity if all the land was in B land condition is 2500 AE. There are 6 breeder paddocks, 50% of which are assumed to have deteriorated to C+/C land condition. The analysis is based on a comparison of 2 scenarios. *Scenario 1* - represents an improvement from poor land condition (C+/C) to fair land condition (B) as a result of a wet season spelling strategy for the 3 paddocks that were assumed to have been degraded. *Scenario 2* - represents a continuing decline from poor land condition (C+/C) to very poor land condition (C-/D+) on the same set of paddocks.

Scenario 1 is based on a 4 paddock rotational spelling system (Figure 1) involving the 3 targeted breeder paddocks and 1 spare paddock. The targeted paddocks are in C+/C land condition, and the spare paddock (land condition B) is rotated from within the remaining paddocks on the property. Breeders from spelled paddocks are relocated to steer paddocks for the wet season, and if a free paddock is not available in the rotation, the displaced steers are agisted for 180 days and sold direct ex-agistment. Each of the 3 paddocks receives 2 successive full wet season spells, is grazed through the following wet season, given another 2 wet season spells, and is then spelled once in each subsequent 3 year period. To accommodate this spelling regime, agistment of 100 steers occurs in each of years 2 to 7. This particular scenario represents

an accelerated recovery attempt to test the scope for economic returns under challenging conditions - in practice a more conservative spelling regime (e.g. 1 year spell and 2 grazing without agistment) may be effective, but would take longer to effect a recovery in paddock condition. Recovery rates of 33%, 66% and 100% are assumed respectively to be reached by years 8, 9 and 10, and land condition B is then maintained from year 10 to 20. The scenarios assume that paddocks are stocked each year according to available end of dry season dry matter (leaving ~ 500-600kg/ha), reflected in the carrying capacities outlined in Table 1. Scenario 2 assumes that the 3 paddocks remain overstocked and continue to decline in land condition, carrying capacity and animal performance, reaching land condition C-/D+ by year 10.

The model simulations were run over 20 years and estimates generated of total enterprise gross margins, gross margin per hectare and gross margin per adult equivalent[1]. The economic impact of the spelling strategy is measured as the difference in gross margins between Scenario 1 (wet season spelling) and Scenario 2 (do nothing). The annual differences for each gross margin measure over the 20 year simulation are converted to a net present value (NPV) by discounting at 10% (MacLeod and Johnston 1990).

Table 1 - Selected parameters for Goldfields property model

Parameter	Land condition		
	B	C+/C	C-/D+
Property area (ha)	28,000	28,000	28,000
Carrying capacity (AE)	2,500	1,800	900
Breeders (AE)	1,400	1,000	500
Av. Breeder mortality (%)	3	4	5
Branding rate (1.5/ 2.5/ 3.5+) (%)	50/55/70	45/50/65	35/45/60
Selling prices ($kg/liveweight basis			
Steers - Export Ox ($)	1.85	1.75	1.65
Steers - weaners/stores ($)	1.90	1.80	1.75
Cows - domestic ($)	1.70	1.60	1.50
Cows - heifers ($)	1.80	1.70	1.60
Weaning weights - steers/heifers (kg/hd)	150	130	120
Sale weights (kg/liveweight basis)			
Steers	320	270	250
Heifers	280	260	240
Cows - cull/CFA	460/500	410/470	390/450
Supplements			
Ration 1 - M8U			
Days fed - Weaners/Breeders/Heifers	90/120/180	90/120/180	0/210/0
Cost ($/head/day) - Weaners/Breeders/Heifers	0.15/0.30/0.23	same	same
Ration 2 - M3UP			
Days fed - Weaners/Heifers	120/0	120/0	210/180
Cost ($/head/day) - Weaners/Heifers	0.16/0	0.16/0	0.16/0.64
Dry licks (200g/day)			
Days fed - Steers	120	120	210
Cost ($/head/day) - Steers	8.40	8.40	14.70

RESULTS

[1] Gross margin = total animal revenue - direct animal production costs

The 20 year profile of the gross margin estimates for the improving and deteriorating scenarios is presented in Table 2. The total gross margin (TGM) for the 28000 ha property at the start of the runs is estimated to be $171,352, while the corresponding estimates of gross margin per ha (GM/ha) and per adult equivalent (GM/AE) are $6.12 and $97.82. The TGM estimates indicate that it would take 6 years for the wet season spelling system to return a TGM that is higher than that of the starting state (Table 2). However, because the pastures are also assumed to continue to deteriorate under the "do nothing" Scenario 2, the spelling option would actually be outperforming the alternative "do nothing" strategy after only 2 years. From this point the TGM increases in each year until the full response of the wet season spelling system (land condition B) is reached in year 10, and is maintained until year 20. The NPV of the spelling option is approximately $1.4 million, suggesting it is economically attractive.

Figure 1 - 4 paddock rotational wet season spelling system used for scenario analysis

Table 2 - Gross margin (TGM, GM/Ha, GM/AE) and net present value (NPV) estimates from the 20 year simulation run - Goldfields case study model.

Year	Total Gross Margin ($)			Gross Margin per Hectare ($/ha)			Gross Margin per Animal. ($/AE)		
	Scenario 1	Scenario 2	Difference	Scenario 1	Scenario 2	Difference	Scenario 1	Scenario 2	Difference
Baseline	171,352			6.12			97.82		
1	127,943	171,352	-43,409	4.57	6.12	-1.55	73.04	97.82	-24.78
2	134,978	148,206	-13,228	4.82	5.29	-0.47	75.50	89.98	-14.48
3	142,815	126,585	16,229	5.10	4.52	0.58	78.30	82.01	-3.72
4	150,774	106,778	43,996	5.38	3.81	1.57	81.05	74.12	6.93
5	159,309	86,620	72,689	5.69	3.09	2.60	83.99	64.70	19.29
6	167,990	69,145	98,846	6.00	2.47	3.53	86.89	55.86	31.03
7	218,976	53,232	165,743	7.82	1.90	5.92	111.16	46.79	64.36
8	227,929	37,070	190,858	8.14	1.32	6.82	113.58	35.70	77.88
9	293,949	23,550	270,399	10.50	0.84	9.66	129.66	25.05	104.60
10-20	369,913	11,391	358,522	13.21	0.41	12.80	146.04	13.52	132.52
NPV			1,369,106			48.90			475.70

The GM/Ha values for the wet season spelling strategy improve from the opening value of $4.57 to $13.21 by year 10, when the system has stabilised at land condition B productivity levels, while the 'do nothing' Scenario 2 deteriorates to $0.41. The NPV of the 20 year differences is $48.90. The GM/AE values also

increase steadily over the 20 year simulation from $73.04 to $146.04 by year 10. The "do nothing" Scenario 2, on the other hand, continues to decline to $13.52 once the pastures have reached the less productive land condition C-/D+. While the difference in the TGM and GM/Ha estimates between Scenarios 1 and 2 become positive by year 3, the GM/AE remains negative for one additional year. This is due to the rapid fall in estimated stocking rate on the deteriorating C-/D+ condition land continuing to offset the more modest gain in stocking rate and cattle performance for improving land condition. From the end of the 4th year on, the difference in the GM/AE is positive in all years with an estimated NPV of $475.70.

DISCUSSION

Although the simulation is based on a single case study example, the projected results suggest that wet season spelling with conservative pasture utilisation prospectively offers economic advantages to northern enterprises whose land condition has declined. Under the 2 scenarios that were explored under the 20 year simulation the enterprise returns, measured in terms of total gross margins, are projected to increase by more than 100% of the baseline level. Moreover, this projected profitability is supported by the NPV of the 20 year sequence of gross margin differences being positive (~$1.4 million). The analysis suggests that the wet season spelling will involve some planning to get the resting sequence for the affected paddocks into a workable rotation. There are also some sacrifices and risks necessarily involved in pursuing the wet season spelling option. For example, to make the 4 paddock rotational system work in a consistent sequence it was necessary to free up pastures for the breeding herd by agisting stock for 6 of the first 7 years; if seasons allow these stock to be feasibly held elsewhere on the property during the wet season the results would be much better. It was projected to take 6 years before the total gross margin under spelling (Scenario 1) exceeded the starting state.

Under real world rangeland conditions things are not likely to always proceed as smoothly as the simple computer simulations and recovery of land condition and cattle performance may take longer than projected. Reduced frequency of wet season spelling in the rotation may reduce the immediate economic sacrifice, but would necessarily be traded for a longer period to land condition recovery. Climatic uncertainty and exposure to high supplementary feeding costs for degraded pastures, in particular, will have a large impact on the bottom line performance of northern beef enterprises (MacLeod *et al*. 2004). While a large part of the rapid decline in gross margins is caused by lower carrying capacity and poor animal performance, heavier reliance on dry season supplementation directly contributed to this result. Escaping this penalty will become increasingly difficult if remedial action, such as wet season spelling, is not undertaken. A do nothing strategy (Scenario 2) is likely to be rewarded with an ongoing deterioration of both land condition and enterprise performance.

REFERENCES

Chilcott, C. R., McCallum B.S., Quirk M.F. and Paton C.J. (2003). *Grazing Land Management Education Package Workshop Notes* – Burdekin. Meat and Livestock Australia Limited, Sydney

MacLeod, N.D. and Johnston, B.G. (1990). An economic framework for the evaluation of rangeland restoration projects. *Australian Rangeland Journal*. 12(1):40-53.

MacLeod, N.D., Ash, A.A. and McIvor, J.G. (2004). An Economic Assessment of the Impact of Grazing Land Condition on Livestock Performance in Tropical Woodlands. *The Rangeland Journal*. 26(1):49-71.

MacLeod, N.D., and McIvor, J.G (2007). Quantifying production-environment tradeoffs for grazing land management – A case example from the Australian rangelands. *Ecological Economics*. 65:488-97.

Post, D., Bartley, R., Corfield, J., Nelson, B., Kinsey-Henderson, A., Hawdon, A., Gordon, I., Abbott, B., Berthelsen, S., Hodgen, M., Keen, R., Kemei, J., Vleeshouwer, J., MacLeod, N. and Webb, M., (2006). Sustainable Grazing for a Healthy Burdekin Catchment, CSIRO, Canberra.